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A CROCODILIAN SKELETON FROM THE MORRISON FORMATION AT CANYON CITY, COLORADO

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INTRODUCTION

In the collection of fossil Crocodilia in the United States National Museum is a series of vertebrae with an ilium, and some scutes, that deserve notice. I am indebted to Mr. C. W. Gilmore, Curator of Vertebrate Paleontology at the National Museum, for permission to describe this material.

The specimen consists of fourteen presacral, two sacral, and three caudal vertebrae, the left ilium, three well-preserved scutes, half of another scute, and fragmentary portions of other scutes. It constitutes No. 5836 of the National Museum Collections. (Original Number 1683.) It was collected by M. P. Felch in 1884 from a level in the Morrison Formation near Canyon City, Colorado, slightly above the principal bone level.

The preservation is peculiar. The remains are imbedded in a block of white sandstone. The centra of all the vertebrae are exposed, also the ventral surfaces of the transverse processes in the caudals, the sacrals, and the last four presacrals. The next ten presacrals have the left sides of the neural arches and ventral surfaces of the transverse processes exposed, but the right sides are still imbedded in the matrix, if they are present.

In the region including the seventh to the fifth presacrals, the column has been split vertically immediately to the right of the centra. This exposes the centra on one block and the impressions of the centra with fragments of bone on the other. The spines have been split vertically, so portions of them appear in each block. The separation has been slightly different in the fourteenth presacral, so that the section of the neural canal is not exposed.

On either side above the spines, sections of scutes appear, apparently in their original positions, indicating the relations of the scutes to the vertebral column. On the right side three complete scutes and portions

[1]Contributions to the Osteology, Affinities, and Distribution of the Crocodilia, No. 26.

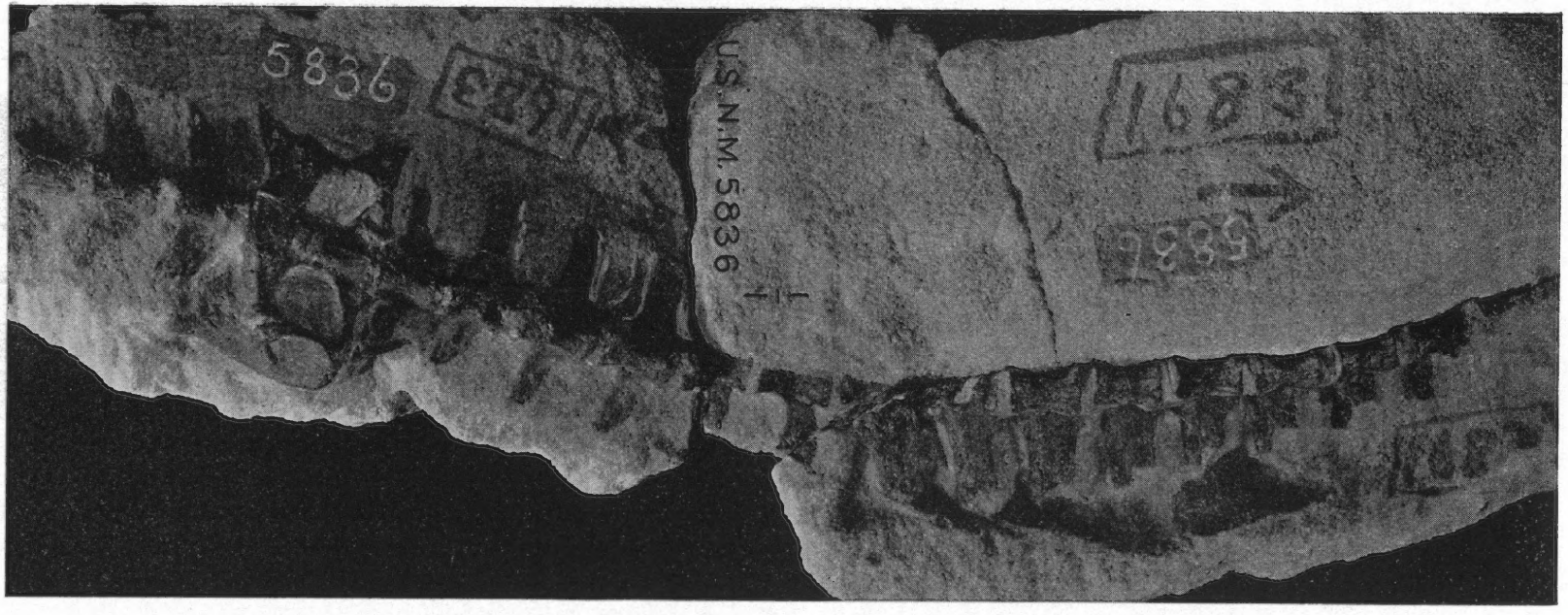

Fig. 1. *Goniopholis* sp. Skeleton. U. S. Nat. Mus. No. 5836. Natural size. Inferior view.

of two others are exposed on the surface, showing their dorsal characters. The inferior and external aspects of the left ilium are exposed.

The identification of the specimen is not certain. It may be regarded provisionally as a young individual of *Goniopholis* (*Amphicotylus*) *lucasii* Cope.

CHARACTERS OF PRESACRAL VERTEBRAE

The seventeenth presacral vertebra is poorly preserved and its characters cannot be made out. The sixteenth is preserved in section only, and the characters that may be observed are not distinctive. The fifteenth presacral has a long, inclined spine, with a very small antero-posterior diameter.

The fourteenth presacral has a sharp central keel, and the spine is broad antero-posteriorly. The transverse process is of moderate length and is slender. The capitular facet is situated immediately above the level of the upper border of the centrum.

The thirteenth presacral has the centrum rather sharply rounded ventrally, not keeled as in the fifteenth, and not broadly rounded, as in the more posterior vertebrae. The capitular facet is on the transverse process, slightly nearer to the extremity of the latter than to the superior surface of the centrum. The proximal portion of the process, below the capitular facet, is broad; the distal portion, external to the capitular facet, is slender. The spine is broad antero-posteriorly and is semicircular at the summit in the same direction.

The twelfth presacral has a slightly longer centrum than the thirteenth. This centrum is rounded inferiorly. The capitular facet is nearer the tip of the transverse process than to the upper border of the centrum. The height of the spine about equals its length. The tip of the spine is semicircular antero-posteriorly.

In the eleventh presacral the centrum is somewhat damaged. The capitular facet is slightly nearer the tip of the transverse process than is the corresponding facet in the twelfth presacral. The antero-posterior diameter, across the extremities of the zygapophysial processes, is greater in this vertebra than in any other member of the series. The spine is similar to that of the twelfth presacral.

The centrum of the tenth presacral is broadly rounded. The capitular facet is nearer to the tip of the transverse process than in the eleventh presacral, but is still a distinct facet. The spine is similar to those of the eleventh and twelfth presacrals.

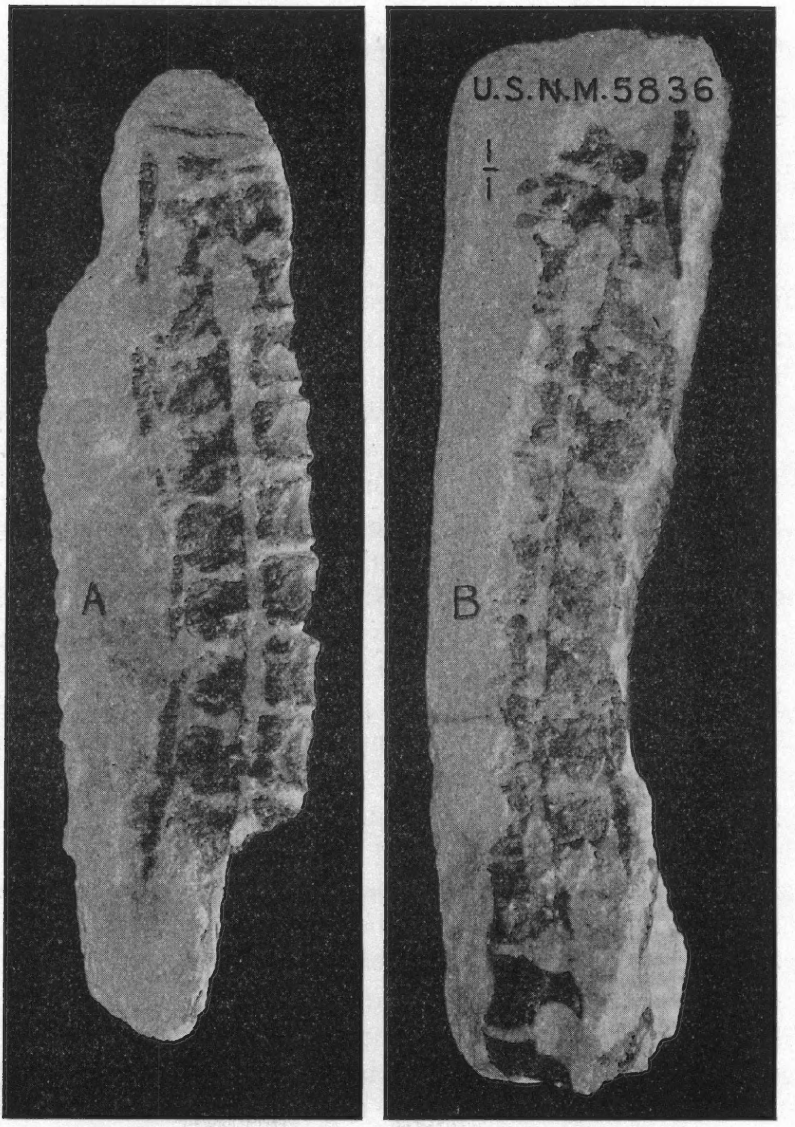

Fig. 2. *Goniopholis* sp. Vertebrae and scutes. U. S. Nat. Mus. No. 5836. Natural size. A, dorsal vertebrae. B, reverse of same block.

The centrum of the ninth presacral is slightly broader than that of the tenth presacral. The capitular facets are very near the tubercular facets. The transverse process in this vertebra is the longest in the series. The spine is similar to that of the preceding presacrals.

The centrum is not preserved in the eighth presacral. The capitular and tubercular facets cannot be discerned clearly. They are evidently very close together on the extremity of the broad transverse process. The spine is relatively high in comparison with the slight antero-posterior diameter.

The seventh presacral is poorly preserved. It is clear, however, that its centrum was of moderate length, and that its transverse processes were not very long, and were rather slender. The tubercular and

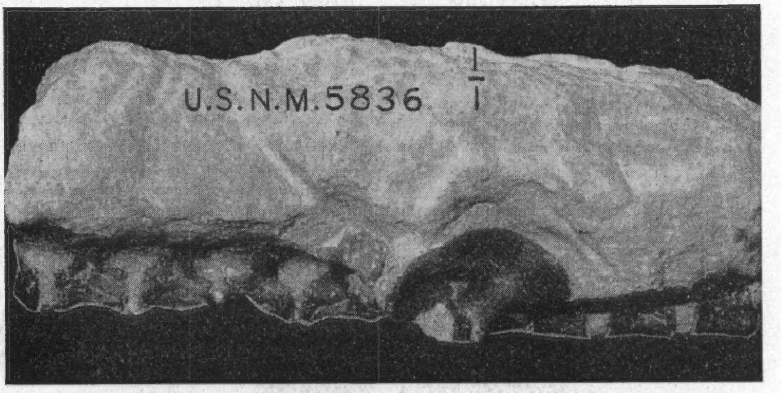

Fig. 3. *Goniopholis* sp. Vertebrae and left ilium. U. S. Nat. Mus. No. 5836. Natural size. Lateral view of vertebrae. External view of ilium.

capitular facets were apparently not separated. This suggests that there may have been a single-headed rib attached to it. On the other hand, the vertebra may have been a lumbar and have had no rib. The latter interpretation is unlikely, however, as it would involve an unusually long lumbar region. Usually there are one or two single-headed ribs between the typical two-headed dorsal ribs and the lumbar region. The spine is not visible.

Presacral six has a centrum of moderate length and a short, rectangular transverse process. It is not well exposed.

Presacral five is poorly preserved. So far as visible it resembles presacral six. A transverse section of the spine and neural cavity shows the spine to be low and the cavity circular in cross-section.

The fourth presacral is well preserved, but only the ventral aspect is exposed. The centrum is long and is broadly rounded ventrally. The transverse processes are of moderate length and are slender. The vertebra has the characters of a true lumbar.

Presacral three is almost identical in characters with presacral four.

The centrum of presacral two is not well preserved. The transverse processes are short and slender; they are directed slightly backward at the tips.

The first presacral has a broad centrum. Its transverse processes are very short and very slender. They are much smaller than those of the second presacral.

The individual was evidently young, and in most of the dorsal vertebrae present the neural arch has separated slightly from the centrum along the sutural connection between these elements, allowing sandy matrix to fill in between them. In the lumbar region there is no such separation.

CHARACTERS OF THE SACRAL VERTEBRAE

The first sacral has a centrum that is both long and broad. It has broad sutural connections with the bases of the sacral ribs. The ribs themselves are much longer than the transverse processes of the last lumbar. The ribs are slender antero-posteriorly, except at their bases. They may be expanded vertically, but their entire vertical extent is not visible. The left rib is joined to the ilium of that side, and its contact is largely covered by matrix. The distal end of the right rib is free, and exhibits the surface for articulation with the ilium as an oblique, triangular, roughened area.

The centrum of the second sacral is slightly shorter than that of the first, but is much broader, and is flattened. The sutures with the ribs are straight, and the ribs are in contact with the centrum throughout practically the entire length of the latter.

The ribs are massively constructed. They are broad antero-posteriorly and apparently vertically as well. An oblique development causes them to exhibit a twisted appearance. The anterior corners of their distal ends are not far from the centra and are low in position, but the posterior corners are far from the centra and are high. Thus the articular surfaces are oblique in position. These surfaces are large.

CHARACTERS OF THE CAUDAL VERTEBRAE

Two caudals are fairly well-preserved, and a third is less well-preserved.

The first caudal has a short centrum. The character of the articular surfaces cannot be made out. The transverse processes are of moderate length; they are broad antero-posteriorly at their bases, and taper rapidly toward their extremities. They are directed backward in a curve which affects their entire lengths.

The second caudal has a long centrum that is rounded inferiorly. The transverse processes of this vertebra are longer and more slender than those of the first caudal.

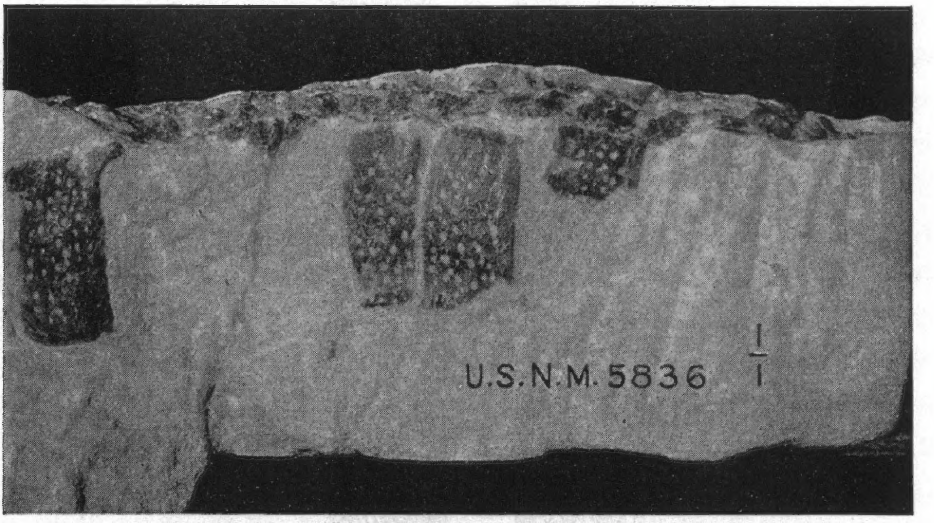

Fig. 4. *Goniopholis* sp. Scutes. U. S. Nat. Mus. No. 5836. Natural size. Dorsal view.

The third caudal is not sufficiently well preserved to admit description except to state that the centrum is shorter than that of the second caudal, and is about equal in length to that of the first caudal.

CHARACTERS OF BONES OTHER THAN VERTEBRAE

The left ilium is well-preserved. It is shorter and proportionally higher than the normal crocodilian ilium of to-day. The anterior peduncle is strongly developed, and is excavated in such a way in its acetabular aspect as to indicate that the dominant thrust from the femur was backward, and downward, and outward, and that the backward component of this thrust was greater than in living crocodilians.

Several dorsal scutes are preserved, and some of them appear to be in their original positions. A fragmentary scute overlies the seventeenth presacral. An incomplete scute overlies the fourteenth. Complete scutes overlie the twelfth and eleventh presacrals. These two are well-preserved. That over presacral twelve has elongate, parallel transverse borders. The anterior border is much shorter than the posterior border, and the external border is inclined inward in the anterior direction. The internal, or median, border is straight. The scute over presacral eleven is slightly narrower antero-posteriorly at its external than at its internal end. Its external and internal borders are parallel to the mid-line of the body.

The scute over presacral seven is long in the transverse direction, and is slender antero-posteriorly. It is subrectangular in outline. Its antero-internal and postero-internal corners are produced into hook-like processes.

All of these scutes have their internal borders arranged in line immediately over the vertebral spines, and are only slightly separated from the latter. They have apparently not been disturbed from their original positions. They indicate two rows of scutes for the dorsal region lying immediately over the vertebrae, without development of muscular tissue between the spines and the scutes. Each scute has many pits, but the pits are small in size and simple in form.

Measurements

Length of vertebral column, presacral 16 to caudal 3, measured along arc	177 mm.
Breadth across broadest transverse processes (est.)	29.5
Length of sacrum	17.5
Breadth of sacrum (est.)	23.5
Length of ilium	21.5
Height of ilium	15.5
Transverse diameter of scute over presacral 7	23.0
Antero-posterior diameter of scute over presacral 7	10.5

CONCLUSIONS

Goniopholid skulls and jaws and teeth are not particularly common, but they are not rare. Articulated vertebrae, however, are very rare, and this specimen serves to illustrate skeletal characters of the group, even though the generic and specific identification is not certain.